



Laser Safety Eyewear

CVI Melles Griot offers three different types of laser safety eyewear in three different styles. Each type of eyewear is suited for a particular application. It is important to consider the wavelength of your laser, the type of exposure, the exposure time, and the energy of your laser before making a selection. CVI Melles Griot strongly suggests that you consult your laser safety officer (LSO), supervisor, or a CVI Melles Griot application engineer to assist you in choosing the proper protective laser eyewear.

- All three types of eyewear are ANSI Z136.1 certified for the US and Asia.
- Diffuse viewing only (DVO) eyewear is low cost, lightweight, and impact resistant.
- Laminated glass technology (LGT) provides good visible light transmission and superior scratch resistance, and it has a high damage threshold.
- Clear light technology (CLT) combines the light weight of the DVO eyewear with the protection level of the LGT eyewear.
- CE-certified models for Europe are also available in contact and goggle format.

Do you need ...

YELLOW DPSS LASER SYSTEMS

CVI Melles Griot 8500 series yellow DPSS laser systems provide excellent beam quality, narrow linewidth, and low optical noise. They are ideal for scanning, microscopy, and spectroscopy applications.

- 750 to 560 nm
- 1.2 mW
- 0.5 inch diameter
- Light and compact



Information Guide For Laser Safety Eyewear

Laser light is extremely focused and intense, and special care should be taken when using lasers. Eye damage is only one of several types of injury associated with lasers. Special care needs to be taken to avoid skin, chemical, and electrical hazards as well. Eye damage is preventable. In most cases, eye damage is caused by negligence or carelessness. Several different types of eye can be damaged depending on the wavelength being used and the amount of absorption at that wavelength.

The cornea can be damaged with small amounts of energy in the visible to near-infrared spectral region (400 to 1400 nm). Damage to the cornea and lens can occur with longer wavelengths (1400 to 3000 nm) and shorter ultraviolet (200 to 400 nm) wavelengths. Another factor in retinal damage is exposure time. Though poorly understood, it has been determined that damage is caused by different mechanisms in different temporal regimes: photochemical ($t > 10$ sec), thermal coagulation ($10 \mu\text{sec} < t < 10$ sec), and thermoacoustic (nsec)¹. With lasers operating in the picosecond (10^{-12}) and femtosecond (10^{-15}) regimes, nonlinear effects make it nearly impossible to extrapolate results from current data. For this reason, conservative safety measures have been outlined by American institutions and their international counterparts.

It is crucial to choose eyewear designed for the output wavelength of your laser. Laser safety eyewear works by attenuating, or reducing, the intensity of the light entering your eye at a specific wavelength. Optical density (OD) is a measure of this attenuation and is defined by ANSI standards. Optical density is wavelength dependent and logarithmic; for every whole number the OD increases, the attenuation increases by a factor of ten.

Selecting Laser Safety Eyewear

Before choosing your safety eyewear, it is necessary to know the laser's output wavelength(s) and the class of the laser you will be operating. The classification is determined by the laser's potential for hazard. Federal law mandates that the laser classification be provided with the laser (typically affixed to the laser). The five most common laser classifications are as follows:

Class I

Lasers or laser systems that do not, under normal operating conditions, pose a hazard.

Class II

Low-power visible lasers, which do not normally present a hazard because of the aversion response of the eye (blinking reflex). Prolonged exposure may cause damage.

Class IIIa

Lasers that typically would not injure the eye if viewed directly or through focusing optics, but may present a greater hazard if used with focusing optics.

Class IIIb

Lasers that may cause damage to the eye if viewed directly or through specular reflections. These lasers typically do not produce hazardous diffuse reflection.

Class IV

Lasers that are hazardous if viewed directly or through specular reflections. Diffuse reflections may also be hazardous. These lasers may also present a risk of skin or fire damage.¹

The safety eyewear you choose should have an optical density (OD) specified at the output wavelength of your laser, that will reduce exposure to Class I radiation levels. OD is given by the exposure type, the exposure time, and the energy output of the laser.

Exposure type is either a diffuse reflection (i.e., a person looking at a laser spot on an illuminated wall) or an intrabeam exposure, which may occur by accidentally stepping down the beam path of the laser.

The exposure time depends on whether a laser is operating with a continuous wave, a single-pulse, or a repetitive pulse. A laser is considered a single-pulse laser if it operates from 0.25 seconds to 30,000 seconds. A single-pulse laser operates with a pulse of less than 0.25 seconds, with a pulse repetition rate of less than 1 Hz. A repetitive pulsed laser emits pulses each less than 0.25 seconds, with a pulse repetition rate greater than 1 Hz.

Once you have determined the optical density, you need to select the style of your eyewear and the visible light transmission that meets your personal requirements.

CVI Melles Griot offers three different types of safety eyewear:

- Diffuse viewing only (DVO) eyewear is low cost, lightweight, and impact resistant. This eyewear is ideal when exposure to laser radiation is limited to diffuse reflection or stray light.
- Laminated glass technology (LGT) provides good transmission of visible light, superior scratch resistance, and an increased damage threshold, making it useful for alignment tasks.
- Clear lightweight technology (CLT) combines the minimal weight of DVO eyewear with the protection level of the LGT eyewear by placing a multilayer ceramic-shielded filter over polycarbonate.

¹"Laser and LED Eye Hazards: Safety", David Sliney, *Optics and Photonics News*, September 1997